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Engineering Design File

PROJECT NO. 23833

OU 7-13/14 In Situ Grouting Project Grout Storage and Mixing

Idaho National Engineering and Environmental Laboratory

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EDF No.: 5135 EDF Rev. No.: 0 Project File No.: 23833

1. Title:	OU 7-13/14 In Situ Grouting Project Grout Storage and Mixing
2. Index Codes: Building/Type	WMF-700 Subsurface Disposal Area; SSC ID N/A; Site Area Radioactive Waste Management Complex
3. NPH Performance Category:	______ or ☒ N/A
4. EDF Safety Category:	______ or ☒ N/A SCC Safety Category: Consumer Grade or ☒ N/A

5. **Purpose:** This engineering design file (EDF) provides the description, design criteria, and requirements for the grout storage and mixing subsystem of the In Situ Grouting (ISG) Project for the pits and trenches of the Subsurface Disposal Area at the Radioactive Waste Management Complex. The information in this EDF is presented as a basis for a performance type procurement of ISG services and is intended to serve as a guideline for subcontract specifications and cost estimating.

Scope: The EDF provides the system design requirements, design codes, design parameter calculations, and capacity requirements based on three operating drill rigs for conveying, storage, and mixing the grout materials for the ISG grout storage and mixing subsystem. A suggested batch plant layout plan drawing and flow diagram is also provided.

Acceptance Criteria: System acceptance criteria are defined in the body of the EDF.

Results: Results are presented in the body of the EDF.

Conclusions: Compliance with project technical and functional requirements is feasible for the grout storage and mixing subsystems presented in this EDF.

Recommendations: The procurement specification for the batch plant should include the raw material storage and mixing capacities as a minimum requirement. For the first year of grouting, the onsite batch plant may not be required because of the reduced amount of grout usage. However, the batch plant design, as proposed in this EDF, should be included in the procurement specification for the second through seventh years as a guide for the bidders. National consensus code compliance for the plant components, as detailed in this EDF, will help ensure safety and a high quality product.

6. Review (R) and Approval (A) and Acceptance (Ac) Signatures:
(See instructions for definitions of terms and significance of signatures.)

	R/A	Typed Name/Organization	Signature	Date
Performer/ Author	N/A	Al Cram, 3G23	Al Cram	9/27/04
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CONTENTS

ACRONYMS

AISC	American Institute of Steel Construction
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
CEMA	Conveyor Equipment Manufacturers Association
EDF	engineering design file
GDE	guide
IBC	International Building Code
INEEL	Idaho National Engineering and Environmental Laboratory
ISG	in situ grouting
ISO	International Standards Organization
OSHA	Occupational Safety and Health Administration
PLC	programmable logic controller
RadCon	radiological control
RWMC	Radioactive Waste Management Complex
SDA	Subsurface Disposal Area
TFR	technical and functional requirements

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OU 7-13/14 In Situ Grouting Project Grout Storage and Mixing

1. PURPOSE

This engineering design file (EDF) will be used as a basis for writing a specification for the procurement of a grout storage and mixing vendor in support of Phase II of the Operable Unit 7-13/14 In Situ Grouting (ISG) Project. As the basis for a specification and to understand project requirements, this EDF provides the design parameter calculations, design codes, and capacity requirements for conveying, storage, and mixing the grout materials for the ISG Project grout storage and mixing subsystem. Suggested silo and mixing plant layouts are provided, as well as the batch plant location. This design work is generated in support of the conceptual design report, as defined in Guide (GDE)-51, “Construction Project Management,” Section I.E.

2. BACKGROUND

In situ grouting will be performed at the Radioactive Waste Management Complex (RWMC), located at the Idaho National Engineering and Environmental Laboratory (INEEL). The Subsurface Disposal Area (SDA) is an area of approximately 39 ha (approximately 97 acres) located within RWMC. In situ grouting is a method of injecting grout into the soil for either contaminant grouting, which stabilizes the waste in the pits and trenches located in the SDA, or for foundation grouting, which is used for structural foundation enhancement needed for cap installation.

Grouting in the SDA will be conducted with a large hydraulic excavator (i.e., trackhoe) that deploys a rotopercussion drill rig to inject grout into the waste under high pressure. A high-pressure grout pumping system will be integrated with the trackhoe drill. Operation, maintenance, monitoring, and radiation control systems will be deployed to support field operations. A grout supply vendor will be subcontracted to provide grout as specified by the project. It is anticipated that the subcontractor will mix the grout on demand at an onsite batch plant. Grout will be supplied to the high-pressure pumping system by truck.

To minimize the risk of mobilizing contaminants within the waste zone, the company has chosen a single-phase, nondisplacement, jet grouting approach, which does not require injection of high-pressure air or free water. This approach drives a drill stem to the bottom of the waste zone, then injects grout at high pressure as the drill stem is removed. During this process, excess grout is returned to the surface along the outside of the drill stem.

This project is anticipated to be accomplished in seven years, with one drill rig used the first year at a reduced production rate, and three drill rigs used for the second through seventh years. This design is based on the required jet grouting capacity of three drill rigs operating simultaneously.

3. SCOPE

The ISG grout storage and mixing subsystem as presented herein is based on the contaminant grout mix design information available at the time of issue. As additional information for the contaminant grout mix and foundation mix design (EDF-5146, “OU 7-13/14 In Situ Grouting Project Grout Selection Basis) becomes available, the suggested design presented in Section 7.2 concerning the number and sizes of storage silos may change. The current suggested design is based on a contaminant grout mix as detailed in Section 6.

The ISG grout storage portion of the system consists of the truck unloading equipment, mechanical and pneumatic conveyors, storage silos, silo bin vents and dust collectors, and screw augers from the silos to a chute above the batch mixer. The ISG mixing portion of the system includes the grout batch plant, grout feed line, and agitator tank located adjacent to the SDA for loading grout into the ready-mix trucks.

The parameter calculations included in Appendix A, Estimates, provide sizing criteria for the storage silos, bulk material conveying equipment, and batch plant based on three operating drill rigs. If additional drill rigs are to be used, the silo sizes, mixer capacity, water line size, and cleanout water tank size must be adjusted accordingly. The size and number of silos for dry material storage were chosen to facilitate grout mix changes—a "one design fits all" approach.

Although the design of this equipment will be subcontracted to the grout supply and mixing subcontractor, consensus design codes must be defined. Also, the batch plant location for an onsite plant must be shown.

4. REQUIREMENTS

Technical and functional requirements (TFRs) are developed for a project before the conceptual design process by project staff and approved by the project engineer. TFR-267, "Requirements for the OU 7-13/14 In Situ Grouting Project (Customer, Project, and System)," was developed as high-level requirements for ISG. During the conceptual design process, the TFRs are reviewed and investigated by the conceptual design engineers. The conceptual design approach is then developed from the investigation and analysis of these customer requirements, and the conceptual design is created. The engineer then develops and specifies design criteria unique to the individual subsystem for subsequent detailed design.

The TFRs unique to the individual subsystems are listed in TFR-269, "Requirements (Assumptions) for the OU 7-13/14 In Situ Grouting Project." The requirements applicable to the ISG grout storage and mixing subsystem are listed below and are followed by a brief discussion of how each requirement is to be met.

The system and components shall be categorized as consumer grade.

See Section 5.

All mechanical components shall be capable of meeting specified performance at an elevation of 5,000 ft above sea level (00037).

See Section 7.1.3.

The system shall include features in the design to facilitate deactivation, decontamination, and decommissioning of all components and equipment (00038).

No special features are anticipated to be required for the mixing and storage subsystem to facilitate deactivation, decontamination and decommissioning.

Quality controls shall be applied commensurate with risk, functions, and importance of system and its components (00045).

No special quality control requirements are anticipated for the grout storage and mixing subsystem since it is anticipated to be supplied as consumer grade.

The system shall allow for regular inspection of major subsystems and components (00047).

Regular inspection of the storage and mixing subsystem components shall be performed in accordance with inspection procedures at intervals as recommended by equipment vendors.

Provide storage for raw product (trucks versus rail).

See Section 7.2.1.

Be able to transfer the raw materials from the delivery vehicles to the storage area.

See Section 7.2.1.

Provide storage for a mixed product.

See Section 7.2.5.

Provide mixing capability—grout specifications—quality—(measure at grout plant to keep in specification).

See Section 7.2.4.

Be able to measure grout compression—static instrument measure.

A density meter will be mounted in the grout mixer recirculation line to warn of a low-density mix, which is normally caused by air entrainment. EDF-4933, “OU 7-13/14 In Situ Grouting Project Measurement and Controls,” provides additional detail on this density meter.

Provide batch plan.

A proposed batch plant layout will be provided to the subcontractor as shown in Appendix B, Drawings.

Provide capability for delivery of mixed product—trucks or grout loop.

See Section 7.2.5.

Be flexible for grout changes.

The grout mix to be used has not been finalized at this date. The storage capacity and number of storage silos is chosen to allow grout recipe changes. The storage design presented here has the capacity of storing five different dry grout components and one dry admixture, which is more than contained in any of the grout mixes under consideration. The contaminant grout is assumed to contain four dry components and one dry admixture. The foundation grout is assumed to contain cement and admixtures. Equipment for additional liquid admixtures can be easily added using tanks and metering pumps. The programmable logic controller (PLC) programming for controlling the batch plant can store 10 or more different mix recipe programs.

Unloading facilities will be capable of unloading sand and a powder commodity simultaneously.

See Section 7.2.1.

Be able to transfer the grout mixture to the grout high-pressure delivery system.

See Section 7.2.5.

Be able to use the cleanup water in the grout mix to minimize waste.

The cleanup water from the mixer, transfer line, and agitator tank will be collected in the trailer-mounted agitator cleanout water tank (see Appendix B, ISG Storage and Mixing Flow Diagram, Sheet 2). Also cleanup water from the ready-mix trucks inside the SDA will be collected in a ready-mix truck cleanout water tank. The cleanout water in the mix truck cleanout water tank will be sampled. If results show that the water meets radiological acceptance criteria, the water will be pumped from the mix truck cleanout water tank, located inside the SDA, into the agitator cleanout water tank, located outside the SDA across the fence. This cleanout water will then be used as a water source in future batches of grout.

5. SYSTEM CLASSIFICATIONS, CATEGORIZATIONS, AND DETERMINATIONS

An ISG safety authorization basis document is being written to address the issue of system safety classification. Until this document is issued, the grout storage and mixing subsystem safety category will be assumed to be consumer grade (INEEL/EXT-03-00316).

The subsystem is Performance Category-1 regarding natural phenomena hazard classification, except that some items may be temporary structures per the requirements of the International Building Code (IBC) or American Society of Civil Engineers (ASCE) Standard 7. The unloading pits and storage silos are IBC Category II structures in regard to Importance Factors. The other conveying and mixing equipment is IBC Category I temporary facilities in regard to Importance Factors. The mapped seismic spectral accelerations for RWMC are as follows:

- Short-period acceleration value is 0.357
- One-second acceleration value is 0.131.

6. ASSUMPTIONS

The following were determined to be assumptions for grout storage and mixing for the ISG Project:

- One grouting drill rig and a spare will be used the first year.
- Three grouting drill rigs and a spare will be used the second and following years.

- Contaminant grouting—The grout will be similar to the nonproprietary mix used in the Tank Closure Reducing Grout Project at Savanna River (WSRC-TR-97-0102); and the mix dry components will consist of approximately 50% by weight of sand, 40% cement, 7% ground blast furnace slag, and 3% silica fume. It is further assumed that the grout dry weight per wet volume is approximately 1.94 kg/l. The admixtures are assumed to be dry sodium thiosulfate powder, liquid high range water reducer and liquid set retarder.

- Foundation grouting—Recipe will contain sand and cement.

- Injected grout volume per vertical foot of waste will be 13.6 gal, as experienced from grouting 12 holes using cementacious grout (INEEL/EXT–02-00233).[a]

- The dry bulk density of sand is 100 lb/ft^3, cement is 94 lb/ft^3, ground blast furnace slag is 85 lb/ft^3, silica fume is 60 lb/ft^3, and sodium thiosulfate is 156 lb/ft^3.

- Semi trucks with trailers (i.e., northwest doubles) have a payload weight of 64,000 lb.[b]

7. DESIGN CRITERIA

7.1 Applicable Design Codes

7.1.1 Unloading Pits

Unloader pits shall be designed and constructed in accordance with American Concrete Institute 318-02, “Building Code Requirements for Structural Concrete;” American Institute of Steel Construction (AISC), “Specification for Structural Steel Buildings, Allowable Stress Design, and Plastic Design;” AISC, “LRFD Specification for Structural Steel Buildings;” ASCE 7-02, “Minimum Design Loads for Buildings and Other Structure;” and the 2003 IBC.

7.1.2 All Mechanical Conveyors (e.g., screw, bucket, or belt)

All mechanical conveyors shall be equipped with machine guards, brakes, control stations, emergency stop buttons, and safety features as specified in American Society of Mechanical Engineers (ASME) B20.1, “Safety Standard for Conveyors and Related Equipment.”

7.1.2.1 Screw Conveyors (e.g., augers)

Screw conveyors shall be designed in accordance with the Conveyor Equipment Manufacturers Association (CEMA) Standard No. 300, “Screw Conveyor Dimensional Standards,” and CEMA Standard No. 350, “Screw Conveyors.” Each conveyor shall be designed to handle the CEMA material classification code, percent trough loading, and material factor for the specific material it is intended to handle (e.g., sand, dry bank has a material code of B37, 15% trough loading, and a 1.7 material factor). These material characteristics are described in CEMA Standard No. 550. The maximum rpm shall be as recommended by the manufacturer for the material being conveyed.

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[a] Based on an E-mail memo from David Nickelson to William Malone, dated 5/13/04.

[b] Based on a telephone conversation between Al Cram, BBWI, and John Whatworth, Ashgrove Cement, Inkom shipping supervisor on 5/11/04.

7.1.2.2 Bucket Conveyors

Bucket conveyors shall be designed in accordance with International Standards Organization (ISO) 5050:1981, "Continuous mechanical handling equipment—Vertical bucket elevators with calibrated round steel link chains—General characteristics" and ISO 7190:1980, "Continuous mechanical handling equipment—Bucket elevators—Classification."

7.1.3 Pneumatic Conveyor Systems

Blow tanks and air receivers shall be designed and code stamped in accordance with ASME Code, Section VIII, Division 1, "Rules for Construction of Pressure Vessels." These vessels shall be equipped with ASME-stamped safety valves. Pneumatic system electrical equipment (such as electrical control panels, junction boxes, and switches) shall be National Electrical Manufacturers Association-rated for the environment in which they will be operating. All elbows in pneumatic conveyor systems shall be designed and reinforced for abrasion resistance. Blowers shall be designed for operation at 5,000 ft above sea level.

7.1.4 Silos

Silos constructed of steel shall be designed and constructed in accordance with AISC, "Specification for Structural Steel Buildings, Allowable Stress Design and Plastic Design" or an equivalent standard. Silos shall be designed for a minimum roof load of 30 psf. The silos shall be designed for a basic design wind speed of 90 mph using the procedures and requirements of ASCE 7 or the IBC. Footings shall be designed for a frost depth of 5 ft. Footings shall be designed so they are adequate to support the structure and keep differential settlements within acceptable limits. Silo design shall follow the guidance provided in American Iron and Steel Institute E-5, "Useful Information on the Design of Steel Bins and Silos." The design shall meet seismic requirements of this EDF, Section 5.

A pressure and vacuum relief vent shall be located on the top of each silo to prevent silo overpressure or vacuum. Each silo shall be equipped with a bin vent and dust collector sized to exhaust the maximum air volume produced by the pneumatic blower. Each silo shall be equipped with a level indicator with remote readout. The dust collector shall have a 90- to 100-psi pulsejet-cleaning feature to maintain filter effectiveness. A differential pressure alarm shall be provided to warn against filter plugging. All silos shall be provided with Occupational Safety and Health Administration (OSHA)-approved structural ladders, platforms, handrails, and cages for maintenance of the equipment on top of the silo. Silo roofs shall not be designed as working platforms. The roofs must be sloped for water runoff. Silos will require a foundation design that shall be provided as vendor data.

7.1.5 Grout Mixing Plant

Mixing plant skids and the agitator tank are to be designed to the vendor standards. Piping connecting to the vendor-supplied skids and agitator tank shall be designed in accordance with ASME B.31.3, "Process Piping," for category D fluid service.

7.2 System Design

The plant layout, silo size, and other information presented in this section serve as a guide for cost estimation and bid evaluation purposes. The subcontractor may choose to provide an off-the-shelf grout mixing plant, including storage silos with entirely different components, sizes, and layout than shown here.

7.2.1 Bulk Material Unloading

The subcontractor will determine the raw product storage for the first year since the grout will most likely be delivered in ready-mix trucks from Idaho Falls. Grout usage is estimated at two ready-mix trucks per day the first year for one operating drill rig as calculated in Appendix A. Because of the large volume of grout usage for years two through seven, it is anticipated that the raw product will be stored in silos located at a batch plant south of the SDA. Grout use for the second through seventh year of production is estimated to be sixteen ready-mix truckloads per day for three operating drill rigs (see Appendix A). It is anticipated that the subcontractor will locate the batch plant onsite for the following reasons:

1. Delivering sixteen truckloads of grout from Idaho Falls per day would require at least eight additional ready-mix trucks with drivers, which is not economically feasible. With a grout plant located onsite, the additional manpower and equipment are not needed.

2. If grouting operations were stopped for any reason with ready-mix trucks in route from Idaho Falls, these truckloads of grout would be wasted.

3. The clock for grout setup time would start when the trucks left Idaho Falls. The allowable downtime before the system would have to be flushed (to avoid grout setup) would be reduced to account for travel time from Idaho Falls.

4. Reuse of the cleanup water in new batches of grout will be much easier if the water can be pumped across the SDA fence to the batch plant rather than trucked to a different location.

It is anticipated that there will be no rail or truck storage. The trucks will be unloaded as soon as they arrive. Even if a rail spur were built for rail delivery of raw materials, the cost of material storage in rail cars would be prohibitive because of demurrage charges.

Rail cars are not anticipated to be used because of the results of a cost analysis (based on a preliminary cost study, Estimate Number 5407, R. D. Roseland, dated 5/26/04), and the uncertainty and scheduling problems associated with rail service. A preliminary cost analysis was performed to determine whether rail delivery rather than truck delivery of cement was feasible. The overall cost of cement delivery by rail was approximately the same as truck delivery, assuming the cement would be shipped from Murray, Utah, the closest Ashgrove® terminal for type V cement. Type I and II cement may also be used in the grout mix, which can be obtained from the Ashgrove® plant in Inkom, Idaho. In this case, shipment by truck would be much cheaper. To accommodate the possibility that materials would have to be shipped from much greater distances, the proposed batch plant location is south of the SDA where a rail spur could be built in the future.

The truck unloading equipment is anticipated to consist of a pneumatic unloading system for powder-type materials such as cement, a mechanical system for unloading dry or damp sand, and pumps for unloading liquid additives. Concurrent operation of a pneumatic transfer system and the sand unloading system will speed up operations. Two unloader pits are anticipated. The pneumatic system will be capable of unloading into all of the five silos in case sand is not used in any of the mixes. The mechanical system will unload into the sand silo only. Four reasons for choosing a mechanical system for sand transfer are:

1. A pneumatic system cannot transfer damp sand. If the sand is obtained locally, it may require washing and will arrive damp. Operating a dryer is very energy intensive and would not be feasible.

2. Pneumatic transfer of abrasive dry sand requires a high pickup velocity of approximately 6000 ft/min for dilute-phase conveying (Power and Bulk Engineering), wearing through the pipe and fittings very quickly.

3. The maximum transfer rate is about 8 to 10 ton/hr using a venturi eductor in a dilute phase transfer system using a 6 in. line.[c] Each truck holds 32 tons; therefore, unloading a truck using this dilute phase system would take about 4 hours, which is considered to be too long.

4. The dense-phase pneumatic transfer system would require an additional material holding tank that would gravity feed the sand into a blow tank.[d] An auger would be required to load sand from the truck into the holding tank anyway.

Considering these pneumatic transfer disadvantages, a mechanical system using an auger and bucket elevator was chosen for sand.

The dry admixtures, if any, will be shipped in sacks. It is anticipated that the sacks will be emptied into the admixture storage bin or a loader bucket by hand. If dry admixtures are delivered in bulk bags, a bulk bag unloader with an auger will be needed.

7.2.1.1 Truck Unloader Pit

The truck unloader pit for sand should be large enough to accommodate unloading equipment, such as the hopper adapter, conveyor feeder and lifting boot. A sloped concrete trough with a cover will be necessary in the side of the unloader pit for the pneumatic or screw conveyor. Unloader pit covers must be supplied to prevent personnel from falling into the pits when they are not in use.

7.2.1.2 Screw Conveyors (augers)

Screw conveyors for truck unloading are anticipated to be sized to unload a truck in 2 hours or less at a minimum rate of 320 ft^3/hr. Screw conveyors for conveying material from the bottom of the silos to the grout batch mixer tanks should be capable of conveying the quantity of each dry component for one batch of grout in 30 seconds or less. The auger system from the silos is anticipated to route to a common chute above the mixing plant that will feed material into the mixer. The motor and conveyor components must be sized to start the conveyor fully loaded. The conveyor feeder should be designed to feed material into the conveyor at a controlled, uniform rate.

7.2.1.3 Bucket Elevator

A bucket elevator is anticipated for use in conveying the sand from the bottom to the top of the sand silo. The bucket elevator must be sized to handle the capacity of the conveyor feeding it. The elevator should be designed to handle the type of material being conveyed in accordance with the manufacturer's recommendations. A "head" platform, 7-ft x 7-ft minimum size, should be provided at the top of the bucket elevator for maintenance operations. Inlet and discharge openings should be connected to other equipment in a manner to completely enclose the moving elements of the elevator. A hand-operated conveyor safety stop switch shall be located at both the bottom and top of the elevator.

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[c] Based on an E-mail memo from Larry Fox of Fox Venturi Products to Al Cram dated 5/10/04.

[d] Based on a conversation of Cyclonaire® representative, Steve Witt, with Al Cram, BBWI, 4/26/04.

7.2.1.4 Pneumatic Conveyor System

Pneumatic conveyors for truck unloading are anticipated to be sized to unload a truck of cement in two hours or less at a minimum rate of 32,000 lb/hr. The pneumatic system is anticipated to be capable of unloading cement, ground blast furnace slag, fly ash, or silica fume from trucks and depositing this material into silos. A connection in the transfer line should be provided so that these materials may be shipped in pneumatic tanker trucks (when available) that have the capability of pumping the materials directly into the transfer line feeding into the top of the silos. However, the onsite pneumatic transfer system should be provided because pneumatic tanker trucks may not be available in all cases.

This system is anticipated to consist of a truck unloader hopper connector (i.e., lift boot), hose to the blow tank, 15-psi blower unit, venturi-induced vacuum load and pressure unload blow tank, hard-piped header to diverter ball valves and riser pipes to the top of the silos. The blower unit must be sized to operate at a 5000 ft. elevation. The diverter ball valves need to be near ground level for maintenance access even though additional riser piping is required. A proposed system layout is shown in Appendix B. The blow tank is anticipated to cycle 12 times/hr per vendor information. Based on the unloading rate above, (32,000 lb/hr)/(94 lb/ft3) = 340 ft^3/hr, the blow tank minimum capacity is (340 ft^3/hr)/(12 cycles/hr) = 29 ft^3/cycle. The bulk density of some materials may change substantially when the product is aerated. Since the materials may be highly aerated when loaded into the blow tank and may be further fluidized by nozzles or aeration pads near the bottom of the tank, the bulk density is reduced. Therefore, a blow tank of twice the 29 ft^3/cycle capacity equal to 58 ft^3/cycle may be required.

Samples of the materials to be conveyed (i.e., cement, ground blast furnace slag, and silica fume) should be sent to the pneumatic conveying equipment vendor/manufacturer for conveyability testing prior to final equipment selection and design. The pneumatic system vendor/manufacturer may also provide onsite installation inspection, startup assistance, and operational training.

7.2.2 Silos

The proposed size and number of silos were selected to provide storage and mixing capacity for any anticipated grout material mix. The three large silos, including the spare silo, should be designed to hold the heaviest component—sand. This will allow versatility, so that sand, cement, or fly ash may be stored in any of the large silos. The two smaller silos should be designed to hold ground blast furnace slag, the heavier of slag or silica fume. None of the mixes currently under consideration have more than four dry bulk components and one dry admixture. The design includes three large storage silos, two smaller silos, and a dry admixture bin or silo. The storage silos, as presented in Appendix B, are sized for a two-week supply of grout materials to mitigate delays caused by short-term raw material delivery interruptions.

Silo design should take into account the characteristics, properties, and flow patterns of the material to be stored. Aeration pads may be needed in the cone of the silos to promote the discharge of dry products into the screw feeder.

7.2.3 Admixture Tanks and Storage

A 3,000-gal admixture tank for high range water reducer and a 1,000-gal admixture tank for set retarder are anticipated to be located next to the colloidal batch mixer/control room skid. The liquid admixtures are anticipated to be pumped into the mixer using metering pumps. Dry admixtures, such as sodium thiosulfate, will be added, if needed, using a small silo or bin and auger. Additional admixtures, if needed, are anticipated to be stored in the maintenance shop located near the batch plant on pallets or in 55-gal drums.

7.2.4 Grout Mixing Plant

The grout mixing plant will consist of two separate major pieces of equipment with interconnecting piping. A colloidal batch mixer/control room skid will be needed, sized to mix the capacity as listed in Appendix A. This colloidal mixer will feed grout into the second major piece of equipment, a grout holding agitator tank sized to hold one ready-mix truck full of grout (i.e., 8.5 cy).

The colloidal mixer will be designed to weigh, mix, and pump the mixed grout to the agitator tank. The colloidal mixer should be outfitted with load cells to precisely weigh the mix components. The mixer should be capable of thoroughly hydrating a batch of grout approximately every 5 minutes to maintain the production rate as shown in Appendix A. The water is normally fed either directly from a water tank mounted above the mixer or from a pressurized water line from the agitator cleanout water tank pump (see Appendix B, ISG Storage and Mixing Flow Diagram, Sheet 2). Up to four dry components will be fed one-by-one from silos by screw conveyor with each component being weighed as it is added. Weighing accuracy should be 5% or better.

Precise dosing of liquid admixtures is anticipated to be accomplished using metering pumps. Pressure gauges must be protected from the line fluid with a diaphragm seal or other gauge saver. The mixing plant is anticipated to be provided with a PLC outfitted with a touch panel screen having on/off indications for controlled equipment. The individual functions must be interlocked to eliminate errors, such as feeding material in the wrong sequence or feeding of dry components when there is no water in the mixer. The PLC should be capable of storing at least 10 different grout recipes for easy retrieval and use. Grab samples of the mix may be taken for lab analysis to verify grout quality.

The plant should be capable of manual, as well as fully automatic operation. The control system is anticipated to operate motor starters and relays for all mixing equipment, pumps, metering pumps, water supply solenoid valve, and screw conveyor motors. The mixing plant is normally equipped with a control room, separated from the grout mixer room, housing the control panel and touch screen. The control system should be capable of generating a batch record of each mixer batch and then storing and downloading this information on a memory storage card. The batch record should be capable of being downloaded into a computer.

7.2.5 Agitator tank

The agitator tank is anticipated to be capable of holding approximately one ready-mix truck of grout (i.e., 8.5 cy) to allow filling a ready-mix truck without waiting for additional grout mixing. This agitator tank is anticipated to be mounted on a stand next to the SDA fence to allow gravity feed chute loading of the ready-mix truck, which would be located inside the SDA fence. A stairway and work platform designed in accordance with OSHA standards will be needed for rinsing out the agitator tank.

The grout line from the mixer tank to the agitator tank is anticipated to be sized for a grout flow rate between 3- and 4-ft/sec flow velocity. It is estimated that at steady state usage, a new batch of grout will be flowing into the agitator tank approximately every 6 minutes. If the batch plant is laid out as shown in Appendix B, the line will be approximately 75 ft long, and a low-pressure grout pump integral with the colloidal mixer will be capable of providing the necessary flow. The line will simply feed the agitator tank each time a batch is mixed. Transfer time from the mixer (345 gal) to the agitator tank would be 1.75 minutes using a 5-in. line at 200 gpm and 3.2 ft/second flow velocity.

If a long delay because of interruption of grout usage is anticipated, cleanup water must be added to the mixer and flushed through the delivery line into the agitator tank. From the agitator tank the water will be dumped into the agitator tank cleanup water tank. The entire system will be cleaned out before setup of the grout in the lines and equipment. The cleanup water is expected to be re-used in new batches of grout.

A grout loop is not physically feasible because of the long length a grout loop would have to be to reach the grout receiving hopper at each of the high-pressure grout pumps (1,000 to 1,200 ft each way), compounded by the difficulty of supplying three grout receiving hoppers with a single loop. The grout will be loaded from the agitator tank, located outside the SDA fence, into ready-mix trucks inside the SDA, which will then deliver the grout to each receiving hopper at the drill rig high-pressure pump.

8. RISKS

8.1 Design

8.1.1 Unloader Pits

The subcontractor may determine that the unloader pit for the powder type materials is unnecessary since powder type materials may be delivered in pneumatic tanker trucks that are pressurized for unloading. If the final grout mix does not have sand, obviously the sand unloader pit, as well as the bucket elevator, would be unnecessary. In order to accommodate the technical and functional requirement that the design be flexible for grout changes and to accommodate the foundation grout mix, which is anticipated to contain sand, the unloader pits and equipment for handling sand may be required.

8.1.2 Silos

The number and quantity of storage silos could be reduced if the subcontractor decided to provide only a week’s supply rather than two weeks supply of bulk materials. However, this reduced storage capacity may introduce delays because of material shortages.

8.1.3 Agitator tank

The 1,700-gal agitator tank may be a special design because of the large size or it may be similar to a ready-mix drum mounted in a horizontal configuration called a cassette remixer as manufactured by Karl H. Muhlhauser Co., Germany. On this agitator drum the discharge is from a sealed door that opens at the rear of the drum. Rotating the drum in one direction provides remixing. Rotating the other direction, in conjunction with opening the discharge door provides discharge. The rate of discharge can be controlled by the speed of rotation as well as the degree of opening of the door. The subcontractor will be responsible for the agitator tank design and selection.

8.1.4 Batch Plant Location

In order to avoid INEEL oversight of the batch plant operations, the subcontractor may prefer to locate the plant elsewhere (e.g., at Atomic City). This may add additional radiological control (RadCon) survey requirements for the ready-mix trucks entering and leaving the SDA. Roads would require more maintenance and upgrade. Having the batch plant at a location such as Atomic City may also add additional delays to the grouting operations because of the travel distance of the ready-mix trucks. The subcontract should have a provision for RadCon personnel cost reimbursement and road maintenance/upgrade should the subcontractor choose a different batch plant location.

8.2 Material Availability

8.2.1 Cement Availability

Darrell Dietz, Idaho Falls representative for Ashgrove Cement Co., says that depending on the type of cement needed, there may be a shortage (based on a telephone conversation of Mr. Dietz and Al Cram, BBWI on 5/25/2004). Mr. Dietz stated that in the last two years a lot of cement is being exported. The first year's cement should be available at one of the Ashgrove plants; however, the supply for the following years may require additional milling equipment at the source cement plant due to our estimated usage. Our estimated usage is 20 trucks/week. It may be prudent to arrange for the cement supply ahead of schedule. This would allow the cement manufacturer to add additional cement production capability, if necessary, to mitigate this potential problem.

8.2.2 Sand Source

It is possible the sand may be available on the INEEL, depending on the grout mix design and particle size criteria. If it is available, it may need to be processed through a mechanical sieve shaker and possibly washed. This determination should be made before the request for proposal is placed.

8.3 Equipment Longevity

The abrasive nature of sand limits the life expectancy of the conveying and mixing equipment, especially if the provided equipment is not designed for sand. In order to eliminate claims resulting from replacement and downtime costs, it may be prudent to include a subcontract provision that the subcontractor will be responsible for these costs. If the source of the sand is known, and to assist the subcontractor in estimating the equipment lifespan, the CEMA abrasive index of the specific sand source could be provided (CEMA Standard No. 550).

8.4 Safety

Silo failure may result from placing a material in a silo that is not designed for that product. It is not safe to assume that blast furnace slag, sand, or silica fume can be stored in a silo designed for cement storage. Silo design calculations will be required.

Silo explosion or implosion may result from an improperly sized pressure and vacuum safety relief vent. Silo explosion could also result from an improperly sized dust collector filter. With too little filter capacity the silo becomes a dangerous over-pressurized tank. A differential pressure alarm warning of filter plugging must be provided and tested periodically.

9. LOGISTICS SUPPORT

Logistics required to support the grout storage and mixing subsystem at the batch plant include the following:

- 440 volt, 3 phase power
  - pneumatic blower—15 hp
  - bucket elevator and auger—say 10 hp

- augers feeding mixer—say 5 hp running at a time
- mixing plant—30 KVA (casagrande)
- agitator tank—say 10 hp
- cleanup high-pressure hand spray pump—say 5 hp
- plant air compressor—say 7 1/2 hp
- misc. (i.e., metering pump, slurry pump, and instrumentation power)—say 10 hp

Total - $\boxed{\text{92.5 KVA}}$

- Plant air—air compressor provided as part of the blow tank equipment
- Instrument air—conditioned and regulated from plant air
- Water supply—2 in. line going to water holding tank from PW or FW supply
- Traffic control—for 49 trucks/week of raw materials
- Road improvement and maintenance will be required because of the high volume of truck traffic.

10. CONCLUSION

Compliance with project technical and functional requirements is feasible for the grout storage and mixing subsystems presented in this EDF. All components of the grout storage and mixing subsystem are off the shelf or can be commercially fabricated to perform the grouting rate as determined per calculations in Appendix A. The low-pressure piping components for air, water, and grout are commercially available and only require certificates of compliance. The grout mixing plants are available as skid-mounted units in the required capacity per discussions with vendor representatives and review of vendor catalogs. The chute feed pipe into the mixing tank may be a special design. A foundation design for each silo and designs for the unloader pits will need to be submitted by the subcontractor and approved by the contractor.

The ISG grout storage and mixing subsystem is physically feasible and the components are readily available.

It is recommended that the criteria in this EDF be used as a basis for writing a performance-based specification for the ISG Project. In order to get meaningful competitive subcontractor bids, the bidders should be required to bid on the silos, equipment, and batch plant as shown on the Appendix B drawings and detailed in the future specifications. Aspects of the proposed design may be deviated from, however, the bidders should be required to submit details of their desired deviations with their bids and officially request a deviation before subcontract award.

11. REFERENCES

AISC, Specification for Structural Steel Buildings, Allowable Stress Design, and Plastic Design.

AISC, LRFD Specification for Structural Steel Buildings.

American Concrete Institute 318-02, Building Code Requirements for Structural Concrete.

American Iron and Steel Institute E-5, Useful Information on the Design of Steel Bins and Silos.

ASCE Standard 7-02, Minimum Design Loads for Buildings and Other Structure.

ASME B20.1, Safety Standard for Conveyors and Related Equipment.

ASME B.31.3, Process Piping.

ASME Code, Section VIII, Division 1, Rules for Construction of Pressure Vessels.

CEMA Standard No. 300, Screw Conveyor Dimensional Standards.

CEMA Standard No. 350, Screw Conveyors.

CEMA Standard No. 550, Classification and Definitions of Bulk Materials.

EDF-4013, Feasibility Study Technical and Functional Requirements for OU 7-13/14 In Situ Grouting Preliminary Documented Safety Analysis.

EDF-4933, OU 7-13/14 In Situ Grouting Project Measurement and Controls.

GDE-51, Construction Project Management Guide, Section I.E.

INEEL/EXT–02- 00233, Final Results Report, In Situ Grouting Technology for Application in Buried Transuranic Waste Sites.

INEEL/EXT-03-00316, Feasibility Study Preliminary Documented Safety Analysis for In Situ Grouting in the Subsurface Disposal Area.

International Building Code, 2003 Edition, International Code Council, http://www.iccsafe.org/.

ISO 5050:1981, Continuous mechanical handling equipment—Vertical bucket elevators with calibrated round steel link chains—General characteristics.

ISO 7190:1980, Continuous mechanical handling equipment—Bucket elevators—Classification.

Power and Bulk Engineering, Pneumatic points to ponder.

TFR-267, Requirements for the OU 7-13/14 In Situ Grouting Project (Customer, Project, and System).

TFR-269, Requirements (Assumptions) for the OU 7-13/14 In Situ Grouting Project.

WSRC-TR-97-0102, Tank Closure Reducing Grout (U).

Appendix A

Estimates

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Appendix A

Estimates

Grout pump and batch plant parameters

Grout use rate:

Grout column length = 15 ft minus 2 ft overburden = 13 ft. The 15 ft is obtained from the trench depth map as the medium depth (EDF-4013).

Grout volume per ft = INEEL/EXT-02-00233, Sec 5.4, from grouting 12 holes actually used 13.6 gal/vertical ft of waste.

Grout column production rate—

- Relocating to an adjacent hole or initial positioning = 2 minutes
- Drilling to refusal, basalt = 2 minutes (EDF-4013)
- Grouting from bottom of stroke to within 2 ft of surface = 5 minutes (EDF-4013) or 13 ft/5 minutes = 2.6 vertical ft/minute
- Using 3 jets rather than 2 jets gives a hole time of (5 minutes)(2/3) = 3.3 minutes/hole, use 3.5 minutes per Bill Malone

  Total = 2 + 2 + 3.5 = 7.5 minutes/hole

- For the first year use 20 minutes/hole per Bill Malone.

Grout pump parameters selection:

Pump must be capable of injecting 191 L (50 gal) per minute from attached spreadsheet. The required working pressure discussed in meetings has been 10,000 psi (690 bar). This will make the operating pressure 80% of 10,000 psi or 8,000 psi. The previous jet-grouting demonstration at the INEEL used an operating pressure of 6,000 psi (400 bar).[e] Three grout pumps that have at least the 191 L/min @ 8000-psi (552 bar) capacity are:

1. Metax model MP5e, 3.5 in. piston diameter @ 85 strokes/minute, 430 hp. US distributor is Davey Kent
2. CasaGrande model P550, 430 hp, 3.5 in. piston diameter @ 85 strokes/minute (their smaller unit) US distributor is International Construction Equipment, Inc.
3. Tecniwell TW351 Pompa Triplex, 350 hp, 3 in. piston @ 110 strokes/minute, US distributor is Layne Christensen Co.

[e] Eldon Thompson's white paper, January 15, 2004, page 22.

Mixing plant parameters selection:

The first year we will use one drill rig/grout pump. We will design for using three operating and one spare drill rigs/grout pumps the following years. The mixing plant will be sized to provide enough grout for three drill rigs and we will use only one the first year. The drawback of greatly oversizing the mixing plant is grout drying out between batches. The larger mixing plants (20 m^3/hr) may need to be cleaned out between truckloads if an onsite mixing plant is used the first year.

Batch Plant size:

The techniwell 10 m^3/h mix plant has a 500-L mixer tank capacity. The rated capacity is (10 m^3/h)/(500 L/batch) = 20 batches/hr or about one batch each 3 minutes. This is a high mixing rate considering we have to run 4 different augers sequentially for proper grout material weighing. Since we need well-mixed grout, we should use a larger plant in the neighborhood of 5 minutes/batch to provide for proper mixing and operation of the augers, which was used in the spreadsheet. From the spreadsheet we need a mix tank capacity of 167 L for one drill rig (first year) and 1,338 L (second through sixth years) for three rigs for 5 minutes mixing time. The HANY HCM 2500W mixer has a 2,500-L capacity. The Colcrete/Highshear SD2000 mixer has a capacity of 2,000 L. The Tecniwell 20 m^3/h mix plant has a 1,300-L mixer tank capacity. The METAX JM 30 mixer has a 1,400-L capacity. Per Elden Thompson, the agitator tank needs to hold enough grout so the ready-mix trucks will not be waiting very long to get loaded. The agitator tank needs to be about 8.5 yd = 1,717 gal.

Material quantities:

The grout mix dry components (i.e., Portland cement, sand, ground blast furnace slag, and silica fume) will be delivered separately. The dry components have a dry weight/wet volume of 1.94 kg/l. Using the dry weight/wet volume, the dry weight will be (1.94 kg/l) (1,000 l/m^3) = 1,940 kg of dry mix/m^3 of grout.

Silo sizes for three drill rigs:

The silos and loading/unloading system should be sized for use of three drill rigs. Per recommendations of the Ashgrove shipping superintendent and Ernie Carter, we should have at least a two-week supply of materials. The following sizes are for a two-week supply of material.

Sand silo volume = 31,259 ft^3 from spreadsheet, about 26 ft dia × 72 ft eve height silo, 45-degree hopper.

Cement silo volume = 27,269 ft^3 from spreadsheet, about 26 ft dia × 64 ft eve height silo, 45-degree hopper.

Ground blast furnace slag silo volume = 4,413 ft^3 from spreadsheet, about 12 ft dia × 48 ft eve height silo, 45-degree hopper.

Silica fume silo volume = 3,126 ft^3 from spreadsheet, about 12 ft dia × 32 ft eve height silo, 45-degree hopper, make this silo the same as the ground blast furnace slag, 12 ft dia × 48 ft eve height.

Sodium thiosulfate tank volume = 26 ft^3 from spreadsheet, make the silo (or bin) twice this size or pick a commercially available size which is at least 50 ft^3. The size is about 4 ft dia × 5 ft height tank, 45-degree hopper.

Trucks for one drill rig:

Current Idaho law limits the weight of a truck to 105,500 lb. Assuming we would use tractors with bulk hopper trailer followed by a pup bulk hopper trailer, we would be limited by weight rather than volume. For a 105,500 lb GVW tractor-trailer combination, the tare weight per load would be approximately 64,000 lb. See spreadsheet for quantity of trucks.

Trucks for three drill rigs:

See spreadsheet.

Grout delivery trucks for one drill rig:

9 to 11 yd^3 ready-mix trucks are anticipated to be used for delivery of grout from the mixing plant to the high-pressure grout pump hopper . Since our anticipated grout usage will be 2.6 yd^3/hr (2 m^3/hr) for each drill rig, each truckload is anticipated to last (10 yd^3/tk)/(2.6 yd^3 /hr) = 3.8 hours at a drill rig. The first year, production is estimated at 20 minutes per hole. Two trucks will be needed, one in the morning and one in the afternoon if the grout is to be delivered from Idaho Falls..

Grout delivery trucks for three drill rigs:

Since our anticipated grout usage will be 21 yd^3/hr (16.1 m^3/hr) for three drill rigs, each truckload is anticipated to last (10 yd^3/tk)/(21/3 yd^3 /hr) = 1.4 hours at that particular drill rig. The second through seventh year production is estimated at 7.5 minutes per hole. Seven trucks will be needed, one at each HP pump hopper, two in route/being cleaned, one being loaded, and a spare, assuming the grout plant is located onsite.

ISG Admixture usage estimate for 3 drill rigs:

Using the non-proprietary grout recipe from the Tank Closure Reducing Grout Project at Savanna River, (WSRC-TR-97-0102), the admixtures per cubic yard of grout are 2.1 lb of sodium thiosulfate, 175 fluid oz. of high range water reducer, and 56 fluid oz. of set retarder.

Admixture Use Estimate

Hourly use rate, 3 drill rigs, m^3/hr	16.1
Working hours/day	6.5
Daily use rate, yd^3 / day	136.9
Working days/week	7
Weeks of material storage	2
Sodium Thiosulfate, lbs @ 2.1 lbs/ yd^3	4024.3
High Range Water Reducer, gallons @175 fluid oz / yd^3	2620.0
Set Retarder, gallons @ 56 fluid oz / yd^3	838.4
Sodium Thiosulfate silo size, ft^3 @ 156 lb/ft^3	25.8

	2nd-8th yr	1st yr
Grout Use Rate, one drill rig		
Gallon/ft.	13.6	13.6
Ft/hole	13	13
Minutes/hole	7.5	20
Grouting time/hole, min	3.5	
Holes/hr	8.0	3.0
Gallons/hole	177	
Use rate, Gallon/hr	1414	530
Grout pump capacity L/min	191	
Mixing plant parameters		
Grout use rate for one drill rig, m^3/hr	5.4	2.0
Mixing tank capacity (liters) required (one drill rig) to allow 5 minutes mixing time /batch	446	167
Grout use rate for three drill rigs, m^3/hr	16.1	
Mixing tank capacity (liters) required (three drill rigs) to allow 5 minutes mixing time /batch	1338	
Redi-mix trucks per day, one drill rig		2.0
Redi-mix trucks per day, three drill rig	16.1	
Material quantities		
Productive grouting hours/day	6.5	6.5
Total grout mix dry components, lbs/day	446,563	55,820
Sand, lbs/day	223,282	27,910
Cement, lbs/day	183,091	22,886
Ground blast furnace Slag, lbs/day	26,794	3,349
Silica fume, lbs/day	13,397	1,675
Silo Sizes, three drill rigs		
Working days/week	7	4
Silo storage capacity, weeks	2	
Sand capacity, ft^3	31,259	
Cement capacity, ft^3	27,269	
Ground Blast furnace slag capacity, ft^3	4,413	
Silica fume capacity, ft^3	3,126	
Trucks/wk - one drill rig		
Sand		3.5
Cement		2.9
Ground blast furnace slag		0.4
Silica fume		0.2
Total		7.0
Trucks/wk - three drill rigs		
Sand	24.4	
Cement	20.0	
Ground blast furnace slag	2.9	
Silica fume	1.5	
Total	48.8	
Rail cars/wk - three drill rigs, trucks would deliver slag and silica fume		
Sand	7.8	
Cement	6.4	
Total	14.2	

Appendix B

Drawings

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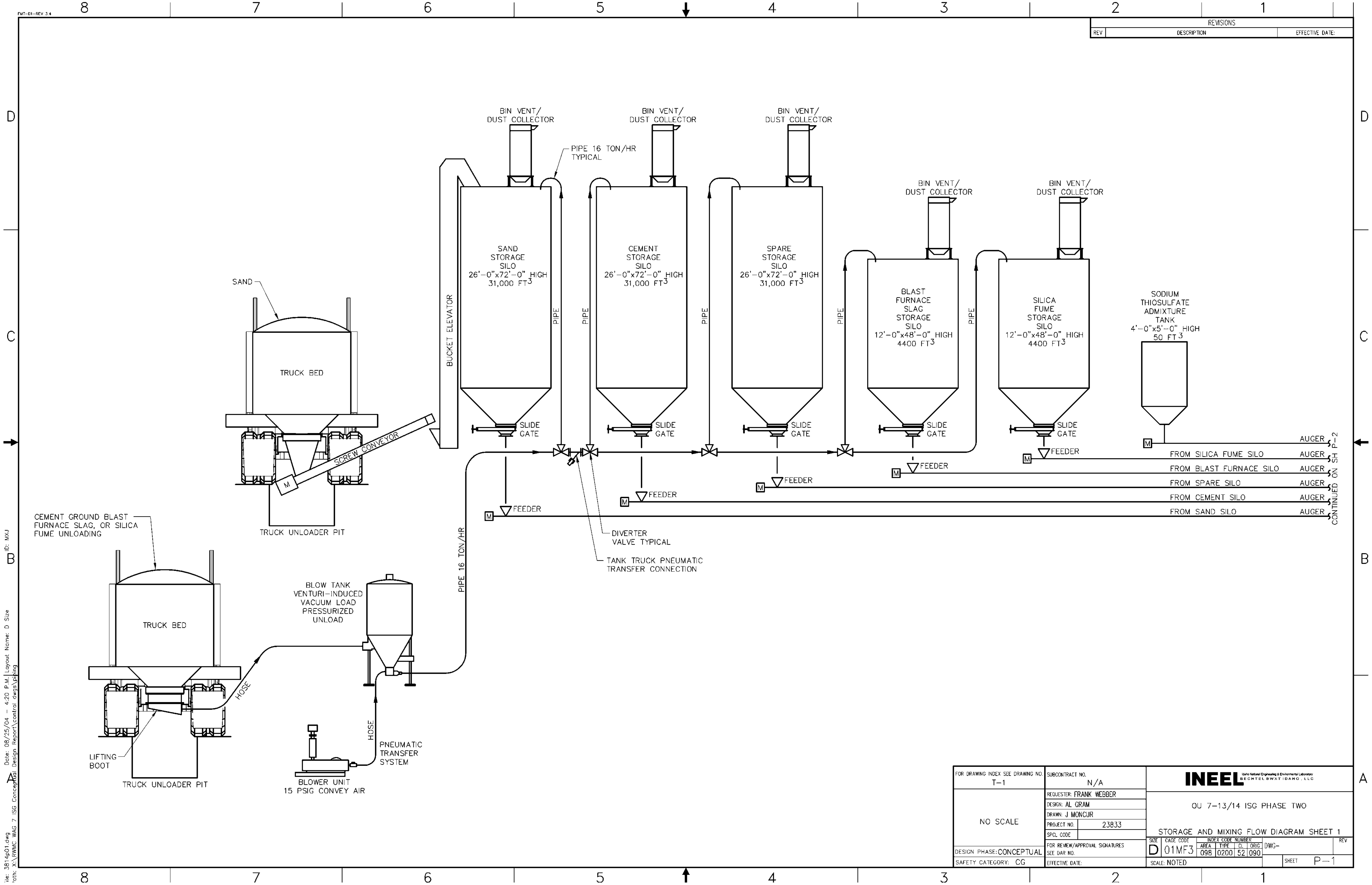
BIN VENT/ DUST COLLECTOR
PIPE 16 TON/HR TYPICAL
SAND STORAGE SILO 26'-0"x72'-0" HIGH 31,000 FT3
CEMENT STORAGE SILO 26'-0"x72'-0" HIGH 31,000 FT3
SPARE STORAGE SILO 26'-0"x72'-0" HIGH 31,000 FT3
BLAST FURNACE SLAG STORAGE SILO 12'-0"x48'-0" HIGH 4400 FT3
SILICA FUME STORAGE SILO 12'-0"x48'-0" HIGH 4400 FT3
SODIUM THIOSULFATE ADMIXTURE TANK 4'-0"x5'-0" HIGH 50 FT3
BUCKET ELEVATOR
PIPE
SLIDE GATE
FEEDER
AUGER
FROM SILICA FUME SILO
FROM BLAST FURNACE SILO
FROM SPARE SILO
FROM CEMENT SILO
FROM SAND SILO
CONTINUED ON SH P-2
DIVERTER VALVE TYPICAL
TANK TRUCK PNEUMATIC TRANSFER CONNECTION
SAND
TRUCK BED
SCREW CONVEYOR
TRUCK UNLOADER PIT
CEMENT GROUND BLAST FURNACE SLAG, OR SILICA FUME UNLOADING
PIPE 16 TON/HR
BLOW TANK VENTURI-INDUCED VACUUM LOAD PRESSURIZED UNLOAD
HOSE
LIFTING BOOT
PNEUMATIC TRANSFER SYSTEM
BLOWER UNIT 15 PSIG CONVEY AIR
REVISIONS
REV
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DESIGN PHASE: CONCEPTUAL
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REQUESTER: FRANK WEBBER
DESIGN: AL GRAM
DRAWN: J MONCUR
PROJECT NO. 23833
SPCL CODE
FOR REVIEW/APPROVAL SIGNATURES
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EFFECTIVE DATE:
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OU 7-13/14 ISG PHASE TWO
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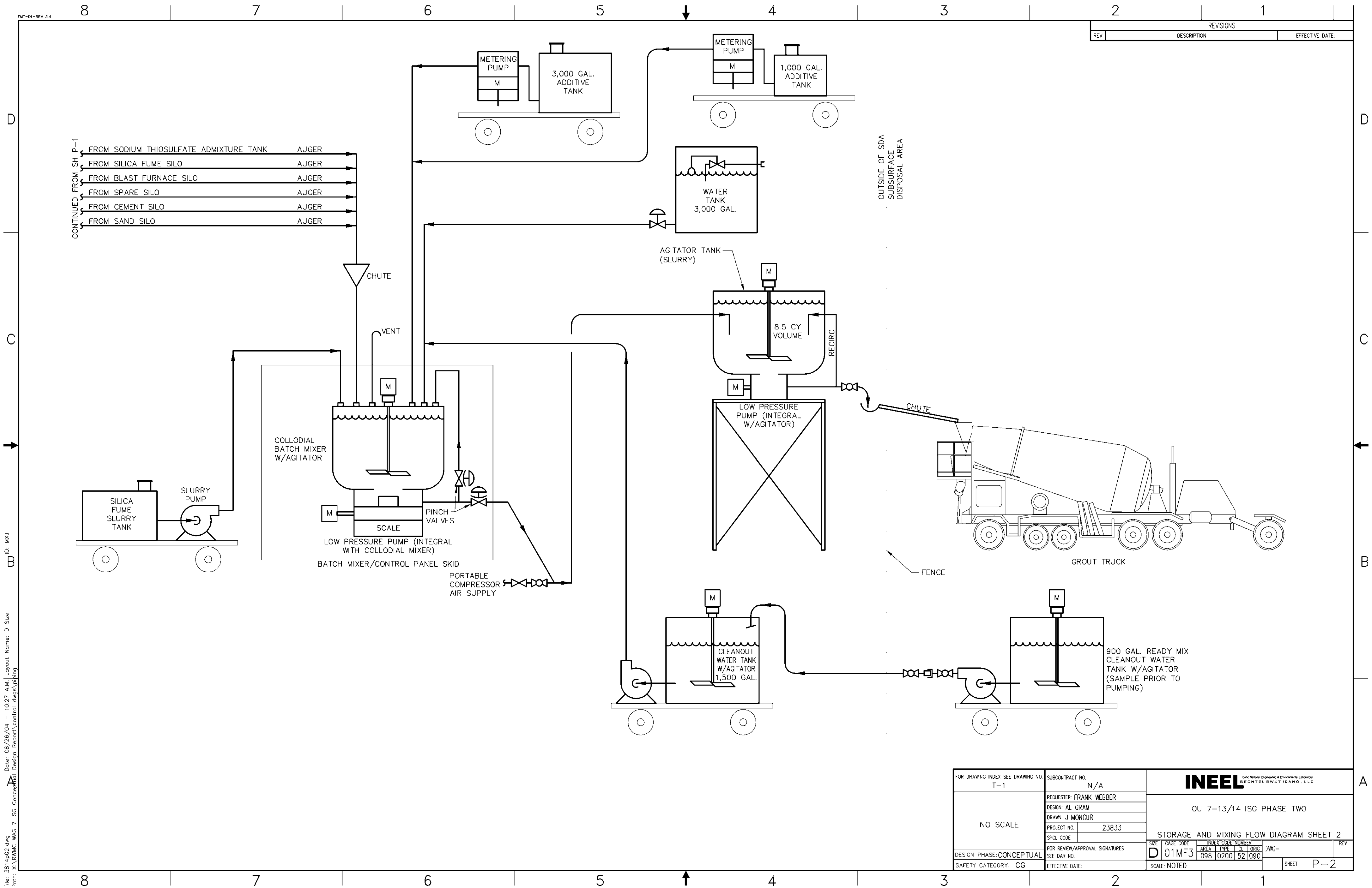
FROM SODIUM THIOSULFATE ADMIXTURE TANK
FROM SILICA FUME SILO
FROM BLAST FURNACE SILO
FROM SPARE SILO
FROM CEMENT SILO
FROM SAND SILO
AUGER
CONTINUED FROM SH P-1
CHUTE
VENT
METERING PUMP
3,000 GAL. ADDITIVE TANK
1,000 GAL. ADDITIVE TANK
WATER TANK 3,000 GAL.
OUTSIDE OF SDA SUBSURFACE DISPOSAL AREA
AGITATOR TANK (SLURRY)
8.5 CY VOLUME
RECIRC
LOW PRESSURE PUMP (INTEGRAL W/AGITATOR)
CHUTE
GROUT TRUCK
FENCE
COLLODIAL BATCH MIXER W/AGITATOR
SILICA FUME SLURRY TANK
SLURRY PUMP
SCALE
PINCH VALVES
LOW PRESSURE PUMP (INTEGRAL WITH COLLODIAL MIXER)
BATCH MIXER/CONTROL PANEL SKID
PORTABLE COMPRESSOR AIR SUPPLY
CLEANOUT WATER TANK W/AGITATOR 1,500 GAL.
900 GAL. READY MIX CLEANOUT WATER TANK W/AGITATOR (SAMPLE PRIOR TO PUMPING)
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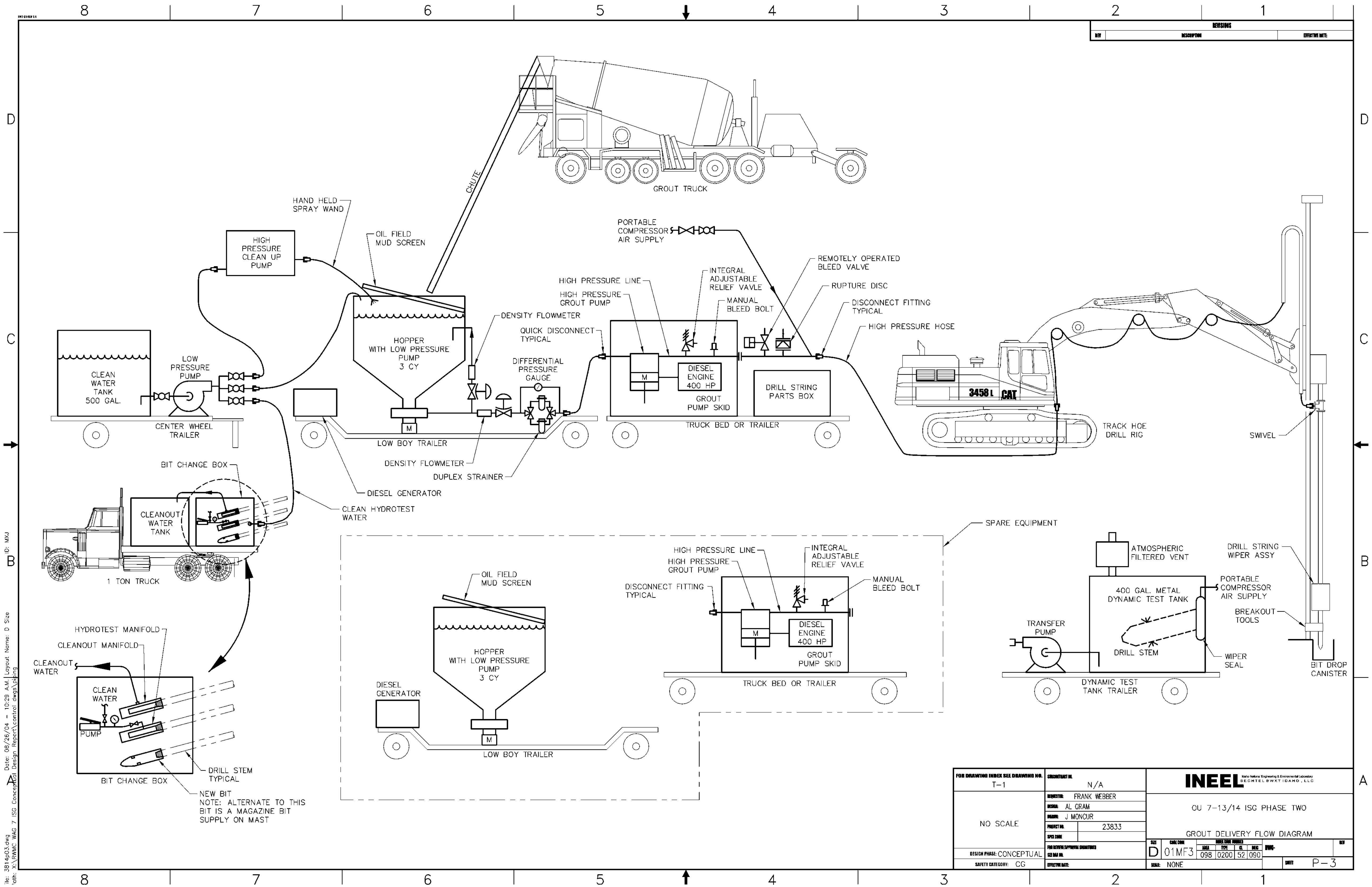
GROUT TRUCK
CHUTE
HAND HELD SPRAY WAND
HIGH PRESSURE CLEAN UP PUMP
OIL FIELD MUD SCREEN
HOPPER WITH LOW PRESSURE PUMP 3 CY
DENSITY FLOWMETER
QUICK DISCONNECT TYPICAL
DIFFERENTIAL PRESSURE GAUGE
HIGH PRESSURE LINE
HIGH PRESSURE GROUT PUMP
INTEGRAL ADJUSTABLE RELIEF VAVLE
MANUAL BLEED BOLT
DIESEL ENGINE 400 HP
GROUT PUMP SKID
PORTABLE COMPRESSOR AIR SUPPLY
REMOTELY OPERATED BLEED VALVE
RUPTURE DISC
DISCONNECT FITTING TYPICAL
HIGH PRESSURE HOSE
DRILL STRING PARTS BOX
TRUCK BED OR TRAILER
TRACK HOE DRILL RIG
SWIVEL
CLEAN WATER TANK 500 GAL.
LOW PRESSURE PUMP
CENTER WHEEL TRAILER
LOW BOY TRAILER
DENSITY FLOWMETER
DUPLEX STRAINER
DIESEL GENERATOR
CLEAN HYDROTEST WATER
BIT CHANGE BOX
CLEANOUT WATER TANK
1 TON TRUCK
SPARE EQUIPMENT
HIGH PRESSURE LINE
HIGH PRESSURE GROUT PUMP
DISCONNECT FITTING TYPICAL
INTEGRAL ADJUSTABLE RELIEF VAVLE
MANUAL BLEED BOLT
DIESEL ENGINE 400 HP
GROUT PUMP SKID
TRUCK BED OR TRAILER
OIL FIELD MUD SCREEN
HOPPER WITH LOW PRESSURE PUMP 3 CY
DIESEL GENERATOR
LOW BOY TRAILER
ATMOSPHERIC FILTERED VENT
400 GAL. METAL DYNAMIC TEST TANK
PORTABLE COMPRESSOR AIR SUPPLY
DRILL STRING WIPER ASSY
BREAKOUT TOOLS
TRANSFER PUMP
DRILL STEM
WIPER SEAL
BIT DROP CANISTER
DYNAMIC TEST TANK TRAILER
HYDROTEST MANIFOLD
CLEANOUT MANIFOLD
CLEANOUT WATER
CLEAN WATER
PUMP
BIT CHANGE BOX
DRILL STEM TYPICAL
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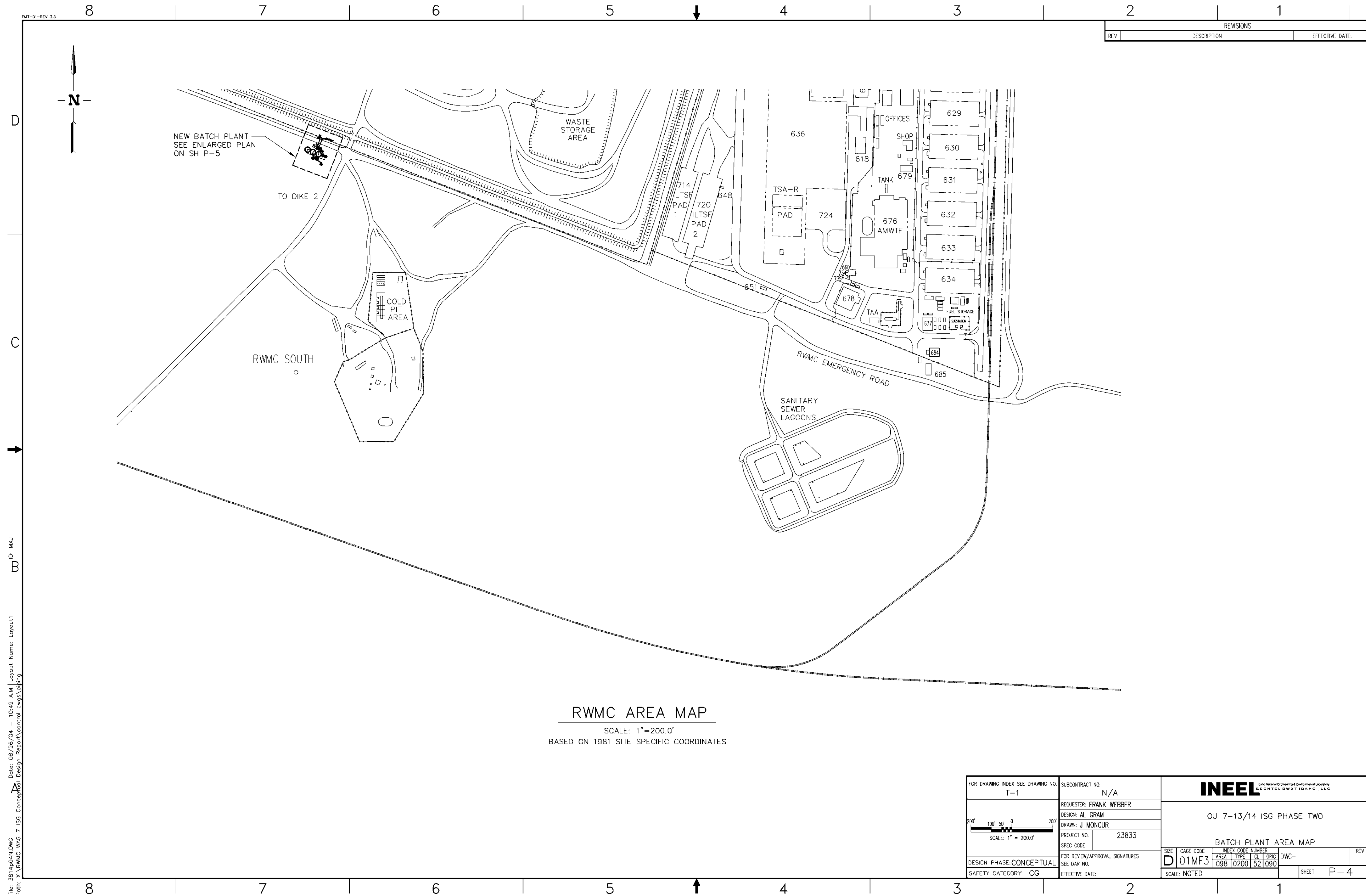
RWMC AREA MAP
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BASED ON 1981 SITE SPECIFIC COORDINATES
NEW BATCH PLANT SEE ENLARGED PLAN ON SH P-5
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RWMC SOUTH
COLD PIT AREA
WASTE STORAGE AREA
714 ILTSF PAD 1
720 ILTSF PAD 2
648
636
TSA-R PAD
724
618
OFFICES
SHOP
TANK
679
676 AMWTF
629
630
631
632
633
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TAA
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RWMC EMERGENCY ROAD
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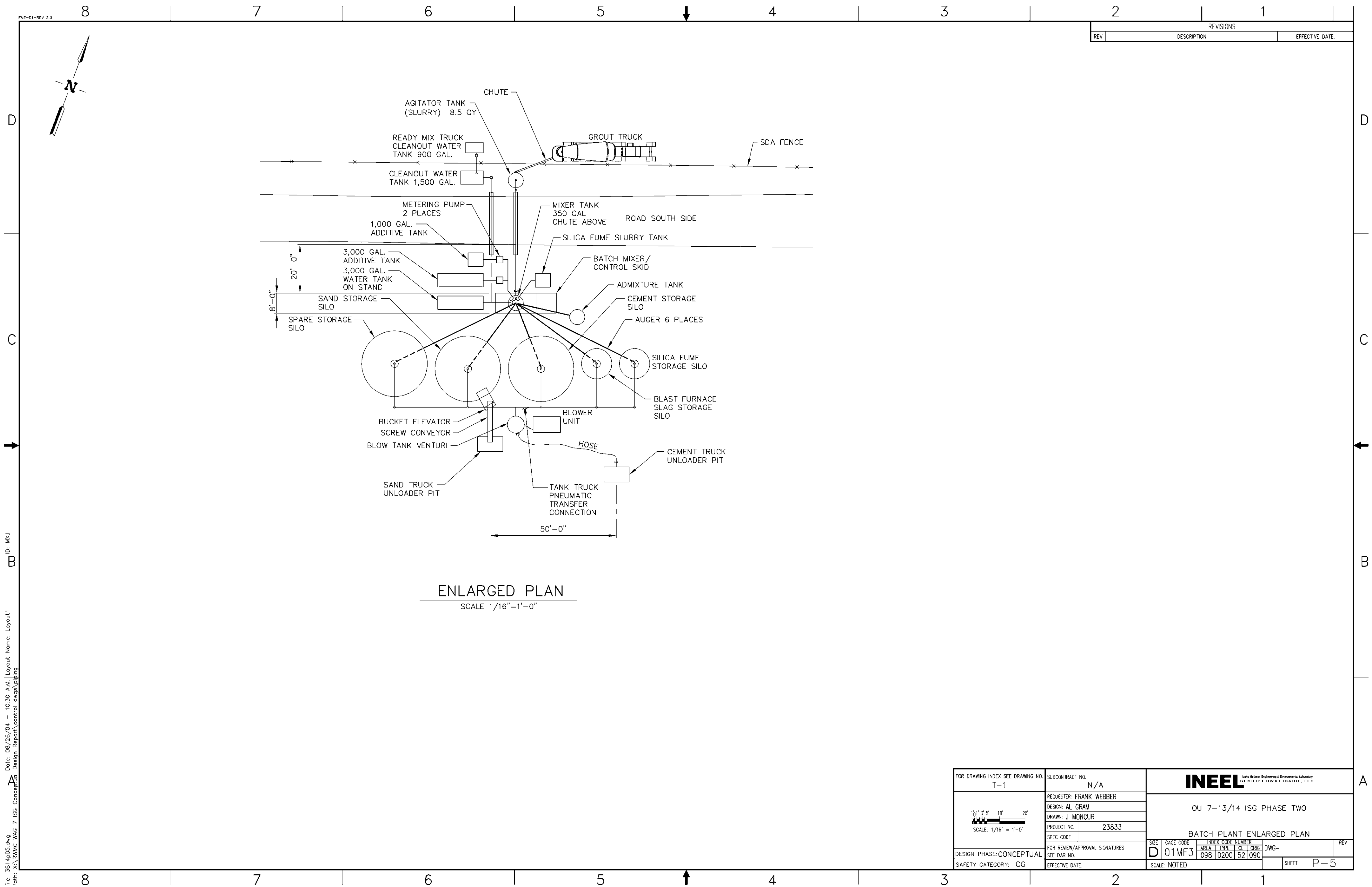
SHEET P-4
REV


AGITATOR TANK (SLURRY) 8.5 CY
CHUTE
GROUT TRUCK
SDA FENCE
READY MIX TRUCK CLEANOUT WATER TANK 900 GAL.
CLEANOUT WATER TANK 1,500 GAL.
METERING PUMP 2 PLACES
1,000 GAL. ADDITIVE TANK
MIXER TANK 350 GAL CHUTE ABOVE
ROAD SOUTH SIDE
SILICA FUME SLURRY TANK
3,000 GAL. ADDITIVE TANK
3,000 GAL. WATER TANK ON STAND
BATCH MIXER/ CONTROL SKID
20'-0"
8'-0"
SAND STORAGE SILO
ADMIXTURE TANK
CEMENT STORAGE SILO
SPARE STORAGE SILO
AUGER 6 PLACES
SILICA FUME STORAGE SILO
BLAST FURNACE SLAG STORAGE SILO
BLOWER UNIT
BUCKET ELEVATOR
SCREW CONVEYOR
BLOW TANK VENTURI
HOSE
CEMENT TRUCK UNLOADER PIT
SAND TRUCK UNLOADER PIT
TANK TRUCK PNEUMATIC TRANSFER CONNECTION
50'-0"
ENLARGED PLAN
SCALE 1/16"=1'-0"
REVISIONS
REV
DESCRIPTION
EFFECTIVE DATE:
FOR DRAWING INDEX SEE DRAWING NO. T-1
SCALE: 1/16" = 1'-0"
DESIGN PHASE: CONCEPTUAL
SAFETY CATEGORY: CG
SUBCONTRACT NO. N/A
REQUESTER: FRANK WEBBER
DESIGN: AL GRAM
DRAWN: J MONCUR
PROJECT NO. 23833
SPEC CODE
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.
EFFECTIVE DATE:
INEEL
OU 7-13/14 ISG PHASE TWO
BATCH PLANT ENLARGED PLAN
SIZE D
CAGE CODE 01MF3
INDEX CODE NUMBER AREA 098 TYPE 0200 CL 52 ORIG 090
DWG-
SCALE: NOTED
SHEET P-5